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## Speaking out about gender imbalance in invited speakers improves diversity

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## Abstract

Omissions of qualified women scientists from major meeting programs continue to occur despite a surge in articles indicating persistent gender-discriminatory practices in hiring and promotion, and calls for gender balance in conference organizing committees.

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It is an incredibly exciting time to be a neuroimmunologist. Neuroimmune pathways in the central nervous system have been shown to contribute to the pathogenesis of an ever-expanding repertoire of neurological diseases from Alzheimer's disease to traumatic brain injury<sup>1</sup>. The explosion in novel findings in this field is evident in the numerous new conferences focused on neuroimmunological mechanisms in health and disease, including those promoted by the Gordon Research Conferences, Keystone Symposia, FASEB and Omics International Conferences. In addition to the exchange of data and ideas that advances the field, for speakers and presenters, these meetings provide an important opportunity for scientists to gain the recognition that is critical for career advancement and for recruiting young scientists to work in their laboratories.

Unfortunately, in 2016, such opportunities were not equally available to female neuroimmunologists, because they were still not equitably represented in all neuroimmunology conferences. An examination of the scientific programs for six conferences revealed substantial gender imbalance in invited speakers at meetings, with most conferences (66%) posting preliminary programs of <50% invited women speakers (Table 1). At a time when increasing diversity among faculty members and trainees has become a central goal for many universities and medical training programs<sup>2–16</sup>, it is disturbing to observe any backward trend. The omission of qualified women from major meeting programs persists despite reported data indicating that women scientists are disproportionately met with discriminatory practices in hiring and promotion<sup>17–19</sup>. Gender

inequity in speaker representation at scientific meetings sends a message of exclusion to women scientists.

To address factors that affect gender balance in invited speaker lists, we performed focused investigations of two neuroimmunology conferences held during 2016—one with and one without gender balance in invited women speakers. We contacted the organizers of these meetings to probe the causes of gender inequity and mechanisms for achieving gender balance for each representative meeting. In the first case, the organizers of a meeting with few women speakers listed on the preliminary program expressed sensitivity to the issue; they replied with the hypothesis that there is a lack of women in senior positions with the appropriate level of expertise in neuroimmunology. The organizers also suggested that the selection criteria for speakers should be identical for both genders. While it is possible that more women had been invited to the conference in question but had declined, or that efforts to enhance geographic diversity might also have had a role in the gender disparity, these reasons were not offered as explanations. Similarly, the organizers did not offer evidence of an existing policy for speaker recruitment consistent with standard guidelines for the inclusion of women, minorities and persons with disabilities, such as those issued by the US National Institutes of Health (<http://grants.nih.gov/grants/guide/notice-files/NOT-OD-03-066.html>).

Given that all conferences attempt to provide a high-level, well-balanced scientific program, and high-impact publications are the currency of science through which competence, contribution and field leadership are judged, we tested those hypotheses by comparing the female and male speakers invited to the conference by assessing the number and impact of their first- and senior-author original scientific publications since the previous conference in 2014. We performed literature searches of senior- and first-author, original scientific article publications by chosen speakers in journals with impact factors of 5–6.99 and 7 or more using PubMed Central database of the National Center for Biotechnology Information (Fig. 1). In the previous 2 years, 47% of male speakers had published at least one article in journals with impact factors of 5–6.99, and 68% of invited male speakers had published at least one article in journals with impact factors of 7 or more (Fig. 1). In comparison, 84% of invited female speakers had published at least one article in journals with an impact factor of 5–6.99, and 54% of invited female speakers had published work in journals with impact factors of 7 or more (Fig. 1b). We also found that 21% of male speakers had not published any articles as first or senior author in journals with impact factors of 5 or more during the years 2014–2016 (Fig. 1c). Only 2 of 13 (15%) invited female speakers had not published any articles in journals with impact factors of 5 or more during the years 2014–2016 (Fig. 1b). These data indicated that the female neuroimmunologists on the preliminary program were as well qualified as their male colleagues.

Given the contention of the meeting organizers that insufficient numbers of qualified female neuroimmunologists exist to provide a better gender balance to the program, we formed an *ad hoc* committee of male and female neuroimmunologists who responded to an email query asking for names of female neuroimmunologists who might be included on a meeting program. A list of 29 women who were not included on the preliminary program but are considered expert contributors to the field was generated that, when added to the invited

female speakers, would have provided gender balance for the total speaker slots. Notably, 72% of female neuroimmunologists who were not included as speakers had published at least one article in journals with impact factors of 5–6.99 between 2014 and 2016, and 55% had published work in journals with impact factors of 7 or more (Fig. 1b). Moreover, the proportion of total women without any articles in journals with impact factors of 5 or more during the years 2014–2016 decreased to 5% with the addition of the women neuroimmunologists not chosen initially.

Overall, the number of high-impact publications might indicate consistency in substantial work in a specific field; therefore, we compared proportion of investigators who had published more than two original scientific articles in journals with impact factors of 5–6.99 or 7 or more, among the invited male speakers with the combined group of invited female speakers and top women neuroimmunologists (Fig. 1c). Similar proportions of men and women (29% and 23%, respectively) had published more than two articles in journals with impact factors of 7 or more. However, 43% of women and only 17% of men had published more than two articles in journals with impact factors of 5–6.99 or less. These data indicated that women neuroimmunologists of requisite scientific productivity do exist and that their inclusion would achieve far better gender equity in speakers invited to this meeting. Conference organizers were informed of these analyses and were sent a list of accomplished women neuroimmunologists for inclusion in their final program. The organizers responded positively, and this resulted in a revised final program with double the proportion of women speakers.

It is noteworthy that when women are assigned positions with the authority to recruit speakers, especially as members of organizing committees, gender equity in scientific presentations at conferences is more likely to be achieved<sup>20,21</sup>. Consistent with that, nonlinear analysis of the proportion of women speakers invited to neuroimmunology conferences in 2016 as they related to the proportion of women on organizing committees (Table 1) revealed a logarithmic increase that began to plateau as the gender ratio of both speakers and organizers approached 1:1 (Fig. 2). Organizers of a conference with gender balance in invited speakers revealed direct efforts to avoid unconscious bias via the recruitment of women to the conference organizing committee. The two female organizers of the FASEB summer conference in Translational Neuroimmunology, at which 56% of the invited speakers were women, confirmed this effect and provided the following statement: “As done at previous FASEB Neuroimmunology meetings, an emphasis was placed to include women and minorities as speakers and discussion leaders and to achieve the greatest geographical representation possible” (M.J.C. and T. Kielan, personal communication). The organizers also added that awareness of unconscious bias against female speakers is a concern for all organizers regardless of gender. Overall, the data refute the idea that a paucity of women scientists with expertise and productivity underlies the gender imbalance in speakers at neuroimmunology conferences. Furthermore, these data suggest that the inclusion of women on organizing committees to ensure active recruitment of women scientists improves not only the gender balance in conference programs but also the quality of the scientific presentations.

Vigilance should be maintained to ensure that women investigators who merit invitations to share their scientific work and insights are included in scientific programs of conferences. Our findings suggest that by the active generation of lists of names of potential speakers and by assessment of qualifications and productivity, the gender balance in invited speakers could be improved while high scientific standards are also maintained at future neuroimmunology conferences. Although this was not analyzed in our study, these methods could also improve the inclusion of other under-represented minorities, including those with diverse ethnic and racial backgrounds, sexual orientations and gender identities, as speakers at meetings, as members of editorial boards and professional committees, and in other invited positions. This can be easily implemented for categories for which such data are readily available (race and ethnicity). Finally, there are established, existing guidelines that recommend selection processes that would achieve these goals for all public and private agencies that provide financial support or underwrite conferences. Adherence to these guidelines should be made a requirement for continued financial support for national and international conferences in all fields.

## ONLINE METHODS

### Correspondence from conference organizers

Participants were notified of the upcoming 2016 conferences via email, which included a link to the preliminary scientific program containing the names and citizenship of all invited speakers. Organizers were contacted via email to inquire about the basis for gender inequity or gender balance in the listed speakers of the preliminary programs; all of the organizers responded via a single-return email. For the preliminary program, the total group of invited speakers was selected for analysis.

### Generation of a list of senior women neuroimmunologists

A list of 29 senior women neuroimmunologists was compiled via email inquiries to 15 neuroscientists and neuroimmunologists of both genders for submission of names. On the basis of the total numbers of speakers, we added the first submitted names of women neuroimmunologists to the group of invited female speakers to compile a list of investigators that would achieve gender equity in the speakers.

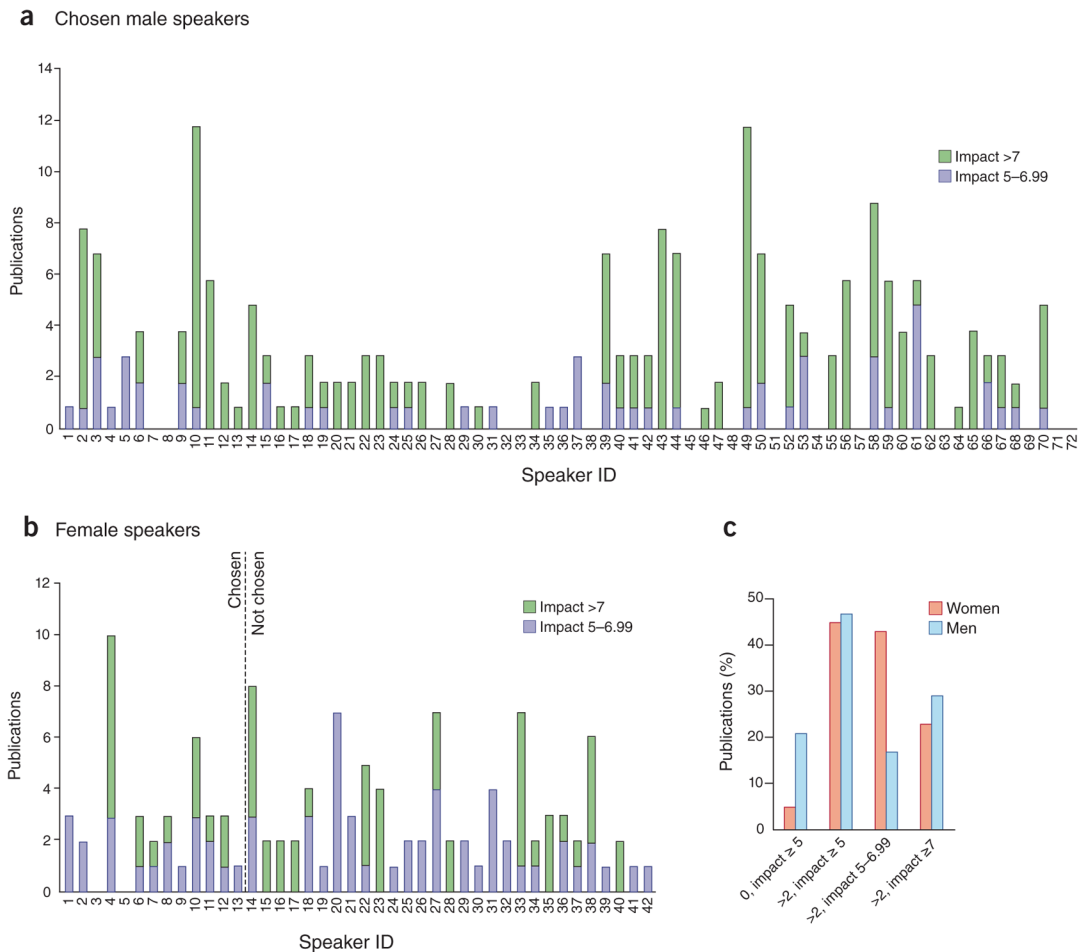
### Analysis of speaker publications

Literature searches for authored publications of the invited male and female speakers and the additional group of female neuroimmunologists were performed using PubMed Central database of the National Center for Biotechnology Information. The number of senior- and first-author publications in journals with an impact factor of 5–6.99 or 7 or more during the years 2014–2016 was determined for each investigator. These years were chosen because the selected conference occurs every 2 years, with the last one occurring in 2014.

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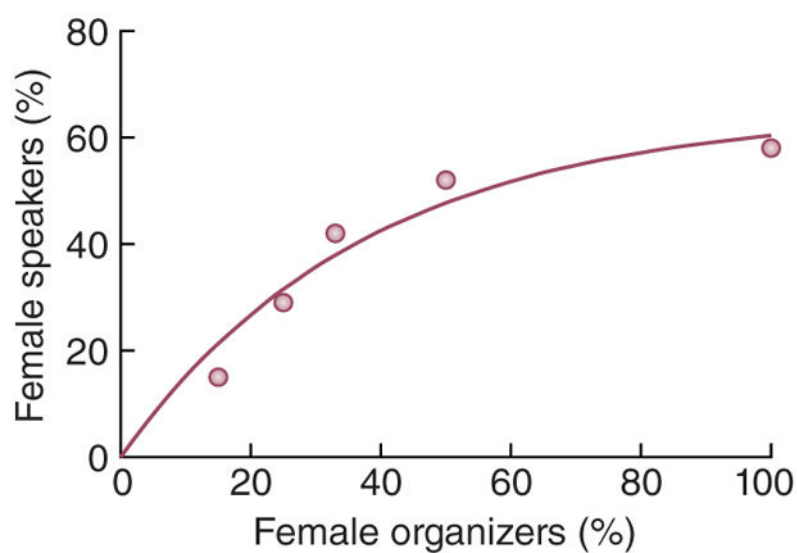
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**Figure 1.**

Quantification of high-impact publications among men and women invited to speak at a conference with substantial gender imbalance, and among a cohort of women neuroimmunologists who were not chosen as invited speakers. **(a,b)** Quantification of senior- and first-author publications in journals with impact factors of 5–6.99 or 7 or more (key) during the years 2014–2016 for male investigators chosen as speakers **(a)** and female investigators chosen as speakers (left) or not (right) **(b)**. **(c)** Overall frequency of women (chosen plus not chosen) and men (key) with no publications in journals with an impact factor of 5 or more (0, impact < 5), more than two publications in journals with impact factors of 5 or more (>2, impact < 5), more than two publications in journals with impact factors of 5–6.99 (>2, impact 5–6.99) or more than two publications in journals with impact factors of 7 or more (>2, impact > 7).





**Figure 2.** Gender balance in speakers directly relates to gender balance in organizers. Nonlinear regression analysis of the relationship between the frequency of speakers and that of organizers in Table 1.

**Table 1**

Gender balance at neuroimmunology conferences in 2016

Conference	Country (month)	Invited women speakers	Organizing committee (female/total)
5th International Conference on Advances in Clinical Neuroimmunology	Poland (June)	6/30 (20%)	No information
GRC Barriers in the CNS	USA (June)	21/41 (52%)	1/2 (50%)
FASEB Summer Conference in Translational Neuroimmunology	USA (July)	19/34 (56%)	2/2 (100%)
13th International Society of Neuroimmunology Congress	Israel (September)	13/85 (15%) (preliminary program)	2/13 (15%)
2nd International Congress on Neuroimmunology and Therapeutics	USA (December)	5/17 (29%) (preliminary program)	1/4 (25%)
5th Cold Spring Harbor Conference on Blood Brain Barrier	USA (December)	5/12 (42%) (preliminary program)	1/3 (33%)

Frequency results are presented as women invited/total speakers invited (third column) or female/total (fourth column).